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GREER, BURNS & CRAIN
300 S WACKER DR
25TH FLOOR
CHICAGO, IL 60606

EXAMINER
UHLIR, NIKOLAS J

ART UNIT	PAPER NUMBER
1773	7

DATE MAILED: 04/30/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

A9-7

Offic Action Summary	Application No.	Applicant(s)	
	09/772,051	SHIDA ET AL.	
	Examiner	Art Unit	
	Nikolas J. Uhlir	1773	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 February 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13 and 15-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) *none* is/are allowed.

6)☒ Claim(s) *1-13 and 15-18* is/are rejected.

7)☐ Claim(s) *none* is/are objected to.

8)☐ Claim(s) *none* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. This office action is in response to the response to restriction requirement and amendment/arguments filed by the applicant on 2/24/03 and 11/15/02 respectively. The examiner acknowledges applicants election of claims 1-13 and 15-18. Currently claims 1-13 and 15-18 are pending.

2. The examiner has carefully considered the applicants arguments and amendments, and has found them to be sufficient in overcoming the prior objection to the specification and 112 rejections. Accordingly, these rejections/objections are hereby withdrawn.

Election/Restrictions

3. Claims 8-13, 15 and 18 are noted to contain nominal method steps. At this time restriction has not been required between the product claims 1-7 and 16 and the method claims 8-13 and 15 because the method claims do not recite any significant manipulative steps and therefore considered as part of the product claims. If the method claims are amended to contain significant method steps they may be subject to restriction based on original presentation.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1-3, 7-10, and 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Parkin (US5583727) in view of Paik et al. (IEEE Transactions on Magnetics, Vol 28, #5, Sept. 1992, pp 3084-3086), further in view of Tani et al (IEEE Transactions on Magnetics, Vol. 27, #6, Nov. 1991, pp 4736-4733).

6. Parkin teaches a magnetic recording medium comprising a substrate, an underlayer deposited on the substrate, and multiple magnetic data recording material layers (data layers) deposited on the underlayer. The substrate is typically glass or an aluminum alloy disk. The underlayer is typically chromium or another suitable material, and the magnetic layer is a Cobalt based alloy (column 9, lines 35-58). Each of the data layers is preferably comprised of a different magnetic material, or of the same material with a different composition. The data layers are required to possess different magnetic moments so that when the superposed flux from the magnetic layers I received by the sensor, the sensor can distinguish the data from different data layers (column 9, lines 59-67). In addition, the data layers are required to have different coercivities to allow writing on each of the magnetic layers independently without affecting data previously written on other layers (column 10, lines 1-3). Parkin teaches that individual data layers can be written upon utilizing a method known as the sequential layer write scheme. This scheme requires that data layers having the highest coercivity are deposited closest to the substrate, with subsequent layers being deposited in order of decreasing coercivity. Materials particularly suited for this purpose include various CoCrPtB alloys (column 10, lines 4-20). Parkin also teaches that these materials can be read by a digital giant magneto resistance sensor (column 12, lines 6-7)

7. Parkin does not teach a magnetic recording medium that comprises a substrate, A first magnetic layer comprised of a CoCr alloy, and at least one second magnetic layer comprised of a CoCr alloy deposed on the first magnetic layer, wherein the first and second magnetic layers contain 8-15 at% Pt and 1-6% B, and the first magnetic layer has a Cr content higher then that of the second magnetic layer, and a larger sum total of non-magnetic elements other then Cr then the second magnetic layer.

8. Paik et al. teaches the effects of B and Cr concentration on the magnetic properties of CoCrPtB alloys that are deposited onto aluminum substrates having a Cr underlayer (pp 3084, left column, last paragraph.) Figure 4 clearly shows how the coercivity of a $CoCrPt_6B_6$ alloy peaks at a chromium concentration of ~10 at%, and decreases as the at% of chromium is increased or decreased. Last, Paik et al. teaches that this alloy is well known to be used as a magnetic media for hard disks (pp3084 1st paragraph, left column).

9. Tani et al. teaches the effects platinum concentration on the magnetic properties of a $CoCr_{10}PtB_3$ alloy film that is deposited on an aluminum substrate having a chromium underlayer (see table 1). Figure 4 clearly shows how the coercivity of this alloy peaks at a Pt concentration of ~14 at%, and decreases as the Pt concentration is increased or decreased.

10. Therefore it would have been obvious to one with ordinary skill in the art to utilize a $CoCr_{10}Pt_{14}B_3$ alloy as described by Tani et al. as the first data layer (closest to the substrate) in Parkin et al. It would have further been obvious to one with ordinary skill in

the art to coat this first layer with additional layers, wherein each additional layer contains less Cr and less Pt.

11. One would have been motivated to make this modification for the following reasons. Parkin clearly shows that the data layers of a multiple data layer magnetic recording media can be suitably formed from various compositions of a CoCrPtB alloy, wherein the first data layer closest to the substrate is the highest coercivity layer, and subsequent layers deposited on the first layer have lower coercivity. Paik et al. and Tani et al. clearly show that a maximum coercivity of ~3000 Oe can be achieved utilizing a CoCrPtB alloy the comprises 10 at% Cr, ~14 at% Pt, and ~3 at% B. Further, Paik et al. and Tani et al. clearly demonstrate how the coercivity of a COCrPtB alloy decreases substantially as the Cr content is lowered below 10 at% and as the Pt concentration is lowered below 14 at%. Thus, there is clear motivation to utilize the $CoCr_{10}Pt_{14}B_3$ alloy as the first data layer in Parkin, and there is clear motivation to decrease the amount of Pt and Cr in subsequent layers deposited on the first data layer.

12. Regarding the limitations of claims 8-19 and 15-16, the examiner takes the position that the limitations of these claims are necessarily met by the combination of Parkin in view of Paik, as the combination would necessarily requires the layers to be "formed" in the recited order.

13. Claims 4-5, 11-12 and 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Parkin in view of Paik et al., further in view of Tani et al. as applied to claim 1-3, 7-10, and 15-16 above, and further in view of Malhotra et al. (US6303217) and Bian et al. (US5789056).

14. Parkin in view of Paik et al., further in view of Tani et al. teaches all of the limitations of claims 4-5, 11-12 and 18 as stated above, except for those limitations detailed below.

15. Parkin in view of Paik et al., further in view of Tani et al. does not teach a magnetic recording medium comprising a substrate, a first underlayer deposited next to the substrate, a second underlayer deposited on the first underlayer, and multiple magnetic layers of a CoCr alloy deposited on the second underlayer. In addition, Parkin in view of Paik et al., further in view of Tani et al. does not teach that the first and second underlayers comprise a Cr alloy that includes at least one element selected from Mo, Ti, W, V, and Ta, wherein the second underlayer contains a larger sum total of elements other then chromium then the first underlayer.

16. Malhotra et al. teaches a magnetic recording media that comprises a substrate, a first underlayer, a second underlayer, and a magnetic recording layer deposed on the second underlayer. The first underlayer can comprise a Cr alloy that comprises between 5-30 at% of Mo, Ta, V, W, Ti etc... The second underlayer can comprise a Cr alloy that contains 5-30 at% of Mo, V, Ta, Ti, etc...or a ternary alloy of Cr that contains 5-30 at% of two elements selected from Mo, Ta, V, Ti, etc... (column 1, line 55-column 2, line 18). The magnetic layer is a cobalt based alloy, including CoCr, CoCrTa, CoCrPt, CoCrNiPtB, and other alloys containing at least 50% Co (column 4, line 19-30). This underlayer structure results in a magnetic recording media that exhibits improved signal amplitude (column 1, lines 50-53).

17. Bian et al. teaches a magnetic recording media that comprises a substrate, a seed layer, a underlayer, and a magnetic recording layer deposited on the underlayer. The seed layer is a alloy of Cr and Ti, wherein the amount of Ti is >5at% (column 2, lines 39-63). The underlayer is comprised of a chromium alloy such as CrV_x, where x is 0-50 at% and $CrTi_y$, where y is 0-30 at% (column 3, line 66-column 4, line 2). The magnetic layer is manufactured from materials including CoCrPt and CoCrPtTa (column 4, lines 8-15). Bian et al. teaches that the amount of Ti in the seed layer affects the signal to noise ratio (S/N) of the resulting magentic media, with a higher Ti concentration resulting in a higher S/N ratio then a lower Ti concentration (see table 2). In addition, Bian et al. teaches that the amount of Ti in the underlayer is chosen with consideration to the composition of the magnetic layer. Ideally, the lattice of the underlayer is matched to the lattice of the magnetic layer. Ti expands the Cr lattice, and so the amount of Ti present is chosen to match the lattice of the magnetic alloy utilized if or the formation of the magnetic layer.

18. Thus, the examiner takes the position that the amount of Ti in both the first underlayer (seed layer) and the second underlayer is a results effective variable, and it would have been obvious to one with ordinary skill in the art at the time the invention was made to optimize the concentration of Ti in each layer to achieve a desired S/N ratio and a desired lattice match between the second underlayer and the magnetic recording layer.

19. Therefore it would have been obvious to one with ordinary skill in the art at the time the invention was made to utilize the underlayer system described by Malhotra et

al. wherein each underlayer comprises an alloy of Cr and Ti as the underlayer used in Parkin in view of Paik et al., further in view of Tani et al.

20. One would have been motivated to make this modification due to the teaching in Malhotra et al. that a magnetic recording medium that utilizes two underlayers comprised of an alloy of Cr and one element selected from Mo, V, Ta, Ti, and W exhibits improved signal amplitude.

21. It is the examiners position that the limitations of claims 11-12 and 18 are necessarily by Parkin in view of Paik further in view of Tani and Malhotra, as the combination as stated above would necessarily require the layers to be "formed" in the required order.

22. Claims 6 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Parkin in view of Paik et al., Tani et al., Malhotra et al., and Bian et al. as applied to claims 4-5 and 11-12 above, and further in view of Bertero et al. (US6150015).

23. Parkin in view of Paik et al., Tani et al., Malhotra et al., and Bian et al. teaches all of the limitations of claims 6 and 13 as stated above, except for those limitations listed below.

24. Parkin in view of Paik et al., Tani et al., Malhotra et al., and Bian et al. does not teach an intermediate layer made of a Co based alloy disposed between the second underlayer and the first magnetic layer.

25. Bertero et al. teaches a magnetic media the comprises a substrate, a chromium or chromium alloy underlayer on the substrate, an ultra thin nucleation layer comprising Co based alloy deposed on the underlayer, and a magnetic layer comprising a Co alloy

such as CoCrPt on the nucleation layer (column 15, likne54-column 16, lines 25). Magnetic media utilizing the nucleation layer exhibit drastically improved coercivity and squareness as compared to media that do not utilize the nucleation layer.

26. Therefore it would have been obvious to one with ordinary skill in the art at the time the invention was made to utilize a thin nucleation layer of a Co based alloy as described by Bertero et al. between the second underlayer and the first magnetic layer described by Parkin in view of Paik et al., Tani et al., Malhotra et al., and Bian et al.

27. One would have been motivated to make this modification due to the teaching in Bertero et al. that magnetic media that incorporate a Co based alloy as a nucleation layer exhibit drastically improved coercivity and squareness as compared to those media that do not utilize a nucleation layer.

Response to Arguments

28. Applicants arguments dated 11/15/02 have been carefully considered. However, the examiner deems the applicants arguments and amendments insufficient to differentiate the instant claims over the applied prior art, in light of the fact that the applicants arguments are directed towards features of the invention that are not required by the instant claims, as will be explained below.

29. In the instant case, the applicants made the following arguments (summarized):

- Parkin fails to teach a magnetic layer having a multilayer structure in which a second magnetic layer is provided on a first magnetic layer. In Parkin, it is essential to provide a spacer layer between two adjacent magnetic layers. IN other words, no magnetic layer is provided directly on another magnetic layer within the multilayer structure. In addition, Parkin fails to teach the relationships of Cr-content and sum total content of nonmagnetic elements other then Cr and which non-magnetic elements have a larger atomic radium than Co for the first and second magnetic layers. All of the other references cited fail to remedy these deficiencies.

30. These arguments are not persuasive. With regards to the applicants arguments relating to the structure of the invention as claimed, the applicant is respectfully directed to the claim language recited in claim 1, wherein the applicant recites the terms "comprises" and the phrase "at least one magnetic layer disposed on said first magnetic layer." The phrase "formed on" is not the same as "formed directly on" or "formed in direct contact with", and is interpreted by the examiner to allow for other layers aside from those specifically recited to be formed between the first and second magnetic layers. Further, the term "comprises" is open language that allows for other layers aside from those specifically recited to be formed in the structure. Thus, the claim language utilized does not require the second magnetic layer to be formed in direct contact with the first magnetic layer. Thus, applicant's argument is moot as it is directed towards features that are not required by the claims.

31. In response to applicants argument that neither Parkin nor Paik, nor Tani teach relationship between of the concentration of Chromium and total elements other then chromium in the first magnetic layer that have a atomic radium larger then Co compared to the second magnetic layer. The examiner acknowledges that the references cited do not specifically teach this feature. However, as discussed above, Parkin clearly teaches the use of CoCrPtB alloys for forming the magnetic layers of a dual magnetic layer recording medium, and teaches that the first magnetic layer should have higher coercivity then the second magnetic layer. The examiner has established through Tani and Paik that the coercivity of CoCrPtB alloys depends on the concentration of Cr and Pt utilized in the alloy, with the coercivity peaking at a Cr concentration of 10 atomic %

and a Pt concentration of 14 atomic % and decreasing as the Cr and Pt concentration drop below 10 at. % and 14% respectively. Thus, given the fact that Parkin teaches using CoCrPtB alloys as the material for both the first and second magnetic layers, the fact that Parkin teaches that the first magnetic layer should have higher coercivity then the second layer, and the fact that Paik and Tani establish that the coercivity of CoCrPtB alloys peaks at a Cr concentration and Pt concentration of 10 and 14 at. % respectively, and that the coercivity of a CoCrPtB alloy decreases as the concentration of Cr and Pt fall below these values, the examiner maintains that one of ordinary skill in the art would have been motivated to utilize $CoCr_{10}Pt_{14}B$ as the first magnetic layer in Parkin, and to use a layer having less Cr and Pt then the first magnetic layer as the second magnetic layer with a reasonable expectation of success. This combination meets applicants requirement that the total concentration of elements in the first magnetic layer other then Cr having a atomic radius >Co be greater then the sum total of these elements in the second layer.

32. The applicant's arguments related to the addition of other references to Parkinin view of Paik and Tani are not persuasive as they are based upon the same issue discussed above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nikolas J. Uhlir whose telephone number is 703-305-0179. The examiner can normally be reached on Mon-Fri 7:30 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Thibodeau can be reached on 703-308-2367. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-0389.

nju
April 29, 2003

Paul Thibodeau
Supervisory Patent Examiner
Technology Center 1700